

Developing a Water-Loss Reduction Plan for Konjic Municipality Water Utility



Transferable Solution

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Project Title: Unaccounted-for Water Reduction Plan

Leader: Water and Sewage Utility, Konjic, BiH

Foreign Partner: Valu Add Management Services, (North Andover, USA)

Local Partner: Hydro-Engineering Institute, (Sarajevo, BiH)

Location: Konjic, Bosnia and Herzegovina

Project Duration: January 2002 – January 2003

EcoLinks Project Investment: Total Project Investment: \$94,774; EcoLinks Grant Support: \$49,894; Project Team Cost Share Contribution: \$46,880.

Best Practice: Transferable Solutions

The project "Developing a Water-Loss Reduction Plan for Konjic Municipal Water Utility" is an EcoLinks Best Practice. Through this EcoLinks-funded project, Konjic Water Utility partnered with a US environmental consulting firm and a local hydrology institute to reduce water losses and improve water resource management within the Utility. Instead of focusing on physical reconstruction of the Utility's infrastructure (which demands large capital investment), the Project Team focused on identifying and reducing unaccounted-for water in the system, through improved management and operational practices. The final output of the project was the development of a Water Loss-Reduction Plan, which outlines low-cost measures to reduce water losses by 2 million m³ per year over a 5-year period, while saving the Utility \$12,000 annually. The Plan also includes a modified tariff system to increase the Utility's revenues by over \$600,000 per year.

This project provides a first step in adopting market-based practices of operation for water utilities which, in the CEE/NIS region, have long been subsidized or subject to unrealistic water pricing. The methodology and guidelines for improving water management developed under this project are transferable to other public utilities throughout the CEE/NIS region.

Project Summary

The Konjic Water Utility manages the water distribution and sewer systems in the city of Konjic, as well as in three other separate water networks in nearby villages. The city utility serves 15,000 customers, including residential, industrial and commercial clients as well as public institutions, through a main pipeline approximately 5 km long and half a meter in diameter. When the waterworks in Konjic was built 40 years ago, water resources were abundant and therefore little attention was paid to conservation. Since construction, however, the city has significantly grown, and with it, so has the demand for water. Inefficient management and use of water resources now result in significant financial losses for the Utility.

The Konjic Water Utility is faced with a high volume of unaccounted-for water loss (UFW). Unaccounted-for water loss (UFW) is defined as the difference between water delivered to the distribution system and water sold. UFW includes two basic components: physical losses and commercial losses. Physical losses represent water lost from pipe leaks in distribution systems, in house connections, and from overflows in distribution tanks. Commercial losses represent water used but not paid for (i.e. from illegal connections and inaccurate metering). Prior to project implementation, unaccounted-for water in the Konjic Water Utility system averaged 60–70% of total water production. In 2000, UFW in the Konjic system equaled more than 6 million m³ of water.

The highest financial cost to the Utility from UFW is caused by the existing tariff system for industrial consumers: industrial consumers make lump-sums payments for approximate water use, rather than paying for the actual volume of water they consume. Lump-sum payment was introduced in response to industries' very high consumption rate combined with their inability to pay water bills due to the generally unfavorable economic conditions in the entire municipality.

Before implementation of this EcoLinks-funded project, the Konjic Water Utility had a limited understanding of how to approach the problem of unaccounted-for water losses. The Utility was unfamiliar with demand-side management practices and how to apply these practices to reduce UFW, while simultaneously meeting an increasing demand for water. The Konjic Water Utility's management had made considerable efforts to increase production levels by tapping additional water resources, rather than eliminating the causes for high UFW rates.

Through this project, the Konjic Water Utility teamed with Valu Add Management Services, a US-based environmental consulting company, and with Hydro-Engineering Institute from Sarajevo, to reduce unaccounted-for water to develop improved water supply system management practices. The Project Team developed a framework for improving the Utility's organizational structure and operating practices, including record keeping, data collection and analysis, use of computer software to monitor water supply, improved customer service and training for the Konjic Water Utility's staff.

As a result of this project, a 5-year UFW Reduction Plan for the Konjic Water Utility was developed. The Plan provides outlines low-cost measures to significantly reduce UFW. The Plan is expected to result in UFW reduction of 25-60%, significantly reduce the Utility's operating costs, increase revenues, and reduce future capital investment needs. In addition to these economic benefits, it is expected that over 70,000 m³ of water will be saved during the first year of the Reduction Plan's implementation.

Project Activities

The goal of this project was to build the Utility's capacity to reduce unaccounted-for water losses and to develop improved water supply system management practices. Project Activities included the following:

1. Establishment of an unaccounted-for water reduction task force

Action(s): The Project Team began by establishing an unaccounted-for water reduction Task Force to coordinate and monitor the implementation of project activities. Managed by the Utility's technical director, the Task Force included consultants from the Local Partner and Utility staff members. Throughout the course of the project, the Task Force met on a weekly basis to coordinate the activities planned for the next period and assess project implementation status.

Product(s): Establishment of a water-loss reduction Task Force.

2. Developing and implementing improved monitoring and record keeping

Action: The Project Team collected and analyzed data and information on the utility's organizational structure, the technical characteristics of the water supply system, the current metering and data recording procedures, the utility's water pricing and billing system, non-metered water losses (fire department, fountains, etc.) and unauthorized losses (e.g. illegal connections) in the system. Using this information, a baseline of current management practices and physical conditions of the utility and its network was developed and potential areas for improvement were identified.

Product(s): 1) An updated list of consumers in the project pilot zone and information on the technical specifications of meters and their locations; 2) A consumer database compatible with global information system (GIS); 3) Guidelines on water intake metering, effective water consumption metering, meter reading, identification of non-metered and unauthorized losses.

3. Improving water supply management and reducing physical losses

3.1. Mapping

Action(s): A pilot zone, which included a variety of consumers (private households, large industrial consumers, medium and small commercial consumers, apartment blocks, etc.) was selected for project implementation. A geodesy survey of the pilot zone was carried out and base maps of the selected zone were scanned and geo-coded. A Global Information System (GIS) file on the water supply network was prepared, along with a database on the network's technical characteristics. Utility staff was trained on topics such as: on-site data collection, use of specialized software for computer-aided designs and GIS (AutoCAD and AutoDesk Map use), how to link the database to objects in the GIS files, etc.

Product(s): (1) Digitized map of water supply system in the pilot zone.

3.2. Water distribution modeling software

Action(s): Dedicated software, "WaterCAD", was purchased for modeling and computer simulation of the water supply network. The software allows the Utility to better analyze the system, including monitoring the weak parts of the pipelines with the highest possibility of rupture.

Product(s): Water modeling software purchased and adapted to local conditions.

3.3. Utility staff training

Action(s): A more appropriate organizational structure for the Utility was designed, and training programs to build staff capacity for the new positions and tasks were developed. Throughout the project, the Utility's staff was trained on data collection (e.g. water pressure, flow measurements,

etc.), data analysis and use of specialized software. Several databases and guidelines were developed for training purposes.

Product(s): 1) A model for calculation of water losses in the network; 2) Guidelines for pilot zone metering; 3) A database of water meters and leak repairs records; (4) Increased staff capacity to collect data and use specialized computer models.

3.4 District metering

Action(s): The pilot zone network was reconstructed to enable measurements of total water flow. All consumers in the zone were provided with water meters. Water consumption was measured through regular meter readings. A night-time metering campaign was conducted to determine three components of the minimum night flow: (1) leakage in the public network mains; (2) leakage in connections; and (3) end-user water loss. The metering campaign also provided flow and pressure data for the calibration of the water distribution model.

Product(s): Pilot zone metering report

4. Developed UFW Reduction Plan (2003-2008)

Action(s): The findings from Activities 1-3 above were used to develop a UFW Reduction Plan. The Plan sets annual targets, goals and actions for the next five years. Major recommendations and their time-line of the Plan are summarized in Table 1 below.

Table 1: UFW reduction plan

Activity	Year 1	Year 2	Year 3	Year 4	Year 5
Reorganize the utility and train the staff	■				
Fully document the network from the production side	■	■	■		
Develop a comprehensive consumer data base	■	■	■	■	■
Implement reporting procedures and analysis of ruptures in the network	■	■			
Identify all connected consumers and meter all connections	■	■	■		
Introduce continuous reading of main meters at all water supply sources				■	■
Solve the problem of lump-sum billing	■				
Install shafts and zone meters			■	■	
Introduce software for efficient billing and monitoring of revenues	■				
Install sufficient insulation valves in the distribution system			■	■	■
Conduct annual water audits		■	■	■	■

Product(s): 1) UFW Reduction Plan including steps for implementation, recommendations for reducing various types of losses, and an implementation schedule and benefits of the proposed activities.

Project Benefits

Capacity Building Benefits

Utility staff was trained on various organizational, technical and administrative methods to reduce UFW and improve water management. Through meetings with the Task Force, representatives from the municipal government became aware of the need to implement fair pricing for industrial consumers instead of lump-sum billing. This is an extremely important step for the utility, as the municipality of Konjic is responsible for water tariff setting. Consumers, both companies and individuals, were also informed on the market value of water and the importance of water resource conservation through good housekeeping measures. A deeper understanding of water conservation issues was passed on to other stakeholders through several meetings and workshops which presented project findings.

Environmental Benefits

The environmental benefits from the project are derived from reduced water losses, which subsequently reduce the need for fresh water intake. Reduced water losses also result in reduced greenhouse gas emissions, as the Utility will use less power for pumping.

It is anticipated that unaccounted-for water losses will be reduced by a total of 70,000m³ during the first year of implementation of the UFW Reduction Plan, and by 35 % (approximately 2 million m³ per year) by the end of the five years.

Economic Benefits

Many economic benefits are generated with the implementation of project recommendations. These include:

- reduced operational costs (as a result of reduced water treatment) equaling approximately \$2,000/year;
- increased revenues from water sales equaling \$ 600,0000 per year (as a result of billing industrial customers for actual water consumed, rather than lump-sum billing);
- increased revenues through the registration and metering of all consumers;
- reduced capital needs of approximately \$ 10,000/year (through avoided investments to extract an additional 20,000 liters per second to meet the demand).

Additional savings may be accrued by reducing the wastewater treatment requirements.

Additional social benefits include the creation of 4 new jobs and improved water supply services to consumers.

Lessons Learned

- Water audits should be performed regularly (annually) in order to identify new UFW.
- Extensive water metering is a pre-requisite of a good water management plan.
- Water audits should provide relevant data to enable selection of a cost-effective UFW strategy. This should include both reductions of physical water losses through a leak detection program as well as reduction of commercial water losses.

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